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West Europe Report

SCIENCE AND TECHNOLOGY

(FOUO 12/80)

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CHEMICALS

NEW MICROWAVE PROCESS FOR PREPARATION OF COMPOSITES

Paris AIR & COSMOS in French 13 Sep 80 p 36

[Article by R.N.]

[Text] Industrial elaboration of glass or carbon fiber-epoxies is accomplished by traditional thermal techniques using the vacuum-pan. The principle is the following: starting from prepolymerous fiber-resin mixtures, the application of heat causes the reticulation of the resin which is transformed into a three-dimensional matrix that locks the reinforcing fibers. This process, it is well known, permits the elaboration of materials with excellent mechanical properties.

Nevertheless, other processes are possible such as those involving ionizing radiation or micro-waves. With the financial assistance of DRET [expansion unknown], a team composed of representatives of ENSCT, CERT-ONERA, and the helicopter division of SNIAS, is working on a process of dielectric microwave heating and has presented the principle as well as several results to ICCM [expansion unknown]. The goal of the research is to understand the nature of the matter-radiation reactions in order to assure the reproducibility of the results and to improve still more the quality of the materials thus obtained, by comparison with the quality of those produced by thermal means. The first results are already encouraging, especially for helicopter blades where the performances obtained are superior to those listed on the specifications.

The microwave procedure is more rapid and should make it possible to obtain more homogenous, and thus more high-performing structures. Its principle is as follows: the specimens of pure and pre-impregnated resins are subjected to polarized electromagnetic radiation at a frequency of 2,450 MHz, either inside a wave-guide [sic] or in a multi-wave hollow. The treated materials behave like imperfect dielectrics; the microwave energy is partially converted into heat energy. This application of heat is exploited to reticulate the organic impregnation matrices. The angle of associated dielectric loss depends on the composition of the resins and the nature of the reinforcing fibers. Improved electromagnetic processing still needs more research aimed at optimizing the mechanical performance of the finished products and at energy economies.

9516
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CHEMICALS

NEW PROCESS MAKES OIL FROM SEWER SLUDGE

Hamburg STERN in German 28 Aug 80 p 201

[Article by Peter Blechschmidt: "The Sheik of Tuebingen"]

[Text] Nature needs millions of years in order to press out oil from small living organisms. A chemistry professor in Tuebingen, Ernst Bayer, produces the same effect in less than 3 hours. And his raw material is just as ample and inexpensive: sewage sludge.

The residues from the sewage treatment plants consist of about 80 percent of organic components, primarily of dead bacteria. Similar "biomass" also forms the basis for our current crude oil. Therefore, the professor came upon the idea of reproducing the natural process of converting micro-organisms into oil and of accelerating the process in the laboratory.

Biomass consists of 40 to 50 percent of carbon with crude oil and coal composed of 85 and 95 percent respectively of carbon. The task, therefore, consisted of separating the ballast substances in the biomass such as oxygen, sulfur and nitrogen. These chemical reactions resulted in Professor Bayer's catalysts--metal oxide mixtures based upon copper and aluminum. As the professor says: "This is simple classic chemistry just as in the old days."

About 40 percent of the carbon contained in the biomass is converted by this procedure into completely isolated oil, which is eminently suited to be a chemical base. Thirty percent is left over as coal which is impurified with inorganic substances contained in the sewage sludge--namely copper, cadmium, phosphates. With continuing deficits in raw materials, this procedure for yielding these substances could be lucrative one day.

German BP awarded Bayer's process a DM100,000-prize in a competition on energy-saving methods. The economic base for industrial exploitation still has to be worked out, but the professor has no doubts that it will be profitable.

The raw materials do not cost anything; on the contrary, the normal treatment costs large amounts of money. The method is relatively simple from a

technical viewpoint and does not require any new large technologies. Professor Bayer says: "A central conversion plant for three or four sewage treatment plants would definitely pay off."

If the entire dry substance of the sewage sludge available in the FRG (constituting about 5 million tons annually) were used for the Bayer method, then up to 2 million tons of oil and up to 1.5 million tons of coal could be obtained--that is about 1 percent of the annual consumption in the FRG.

9527
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ENERGY

SOME DIRECTIONS IN BIOMASS ENERGY RESEARCH REVIEWED

Paris LA RECHERCHE in French Jul-Aug 80 pp 766, 769, 770, 773, 775

[Article by Philippe Chartierx and Suzanne Meriaux. Chartier is research director at INRA [expansion unknown], president of the biomass-energy task force of COMES [Solar Energy Commission], and head of the solar-biomass energy project of the European community. Meriaux is research director and head of the water-energy task force at INRA. She is also head of the agriculture group in COMES.]

[Excerpts] Despite their picturesque or obsolete looks (manure gas, gasogens...), the energy uses of biomass offer quite serious prospects. This particular solar channel, moreover, occupies an important place in forecasts of utilization of new energy sources.

It even occupies the place of honor in the forecasts of the Commissariat on Solar Energy [COMES] for the year 2000 (LA RECHERCHE N. 101, p. 692, June 1979). In that year, solar [energy] would still represent only 5 percent of the overall energy demand of 350 million TEP (oil tonnage equivalent). But the important fact is that 10 to 12 million TEP out of 17 million in solar energy would come from biomass (3 to 5 million TEP through utilization of agricultural wastes and 7 million TEP through valorization of combustible wood). These well known uses in fact have the advantage of being rapidly developable. However, even in the long term, biomass can play a major role. Consider for example a scenario of total conversion to solar, the Alter project of the "Bellevue Group." It is anticipating moderate consumption of 142.5 million TEP in 2050, out of which utilization would account for 37.5 million, 20 in the form of combustible solids, 14.5 in liquid form, and 3 in gaseous form.

From Biomass to Energy

Whether it comes from by-products or cultivated plants, biomass must next be converted into energy vectors--heat, combustibles or fuel, electricity --which lead to the ultimate energy [product]--heat, motive power, specific electricity. Conversion technologies follow two different routes according to the physical state of the vegetable matter one is using: one, a

thermo-chemistry adapted to dry materials such as wood and straw, the other, biological, more appropriate for humid products.

Thermo-chemical processes set in motion reactions linked to temperature under variable conditions of oxidation. The oldest of them--which since the most distant past has been used for cooking food and heating--and the most widespread in the world is combustion. It supplies heat which can then be transformed into motive power or specific electricity.

Another thermo-chemical process, gasification, converts vegetable matter into gas (carbon monoxide and hydrogen). When gasification takes place [begin italics] in the air [end italics], it produces [oxygen-] poor gas that also contains nitrogen, having a weak caloric power (4,000 kilo-J/m). This poor gas can be burned or transformed into mechanical energy, but it is unsuitable for the synthesis of methanol due to its percentage of nitrogen. For achieving the synthesis of this alcohol, it is necessary to proceed to an oxygenated gasification.

Europe has long experience in this field: apart from the gasogens for automobiles put into use from 1920, numerous industrial gasogens are in use around the world; the most advances are the fixed-bed De La Cotte gasogen, which served for synthesis of methanol in 1945, and the reversed flow gasogen taken up again by the Duvant foundations (Valenciennes) and the Imbert foundations (Arnsberg, FRG). Today, attempts are being made to refine the apparatus, improve the yield, the ease of conduction, and their adaptation to the different sources of biomass. The studies made in this area at CNEEMA [expansion unknown] have led to development of a fixed-bed gasogen and a gasogen in suspension. This latter, commercially produced by the Pillard foundations (Marseille) is designed for powdery products such as fine-cut straw and anas [translation unknown] of flax. Efforts are now being made to adapt these materials to oxygenated gasification.

Current research, supported by COMES (Commissariat on Solar Energy) and the European community, is centered on optimization of gasification of vegetable waste and on its oxygenated gasification with the aim of producing methanol, a unit for which could be contemplated in the years just ahead. At the level of demonstrations, the Plessis-Belleville cooperative (Oise) uses anas of flax to make in energy-independent (450 TEP per year) and to sell electric current to EDF, the French Electric [Power] Company.

Pyrolysis-carbonization is also a very old technology, long used to produce charcoal in forest beds. Through decomposition of vegetable matter by heat in absense of air, it provides [oxygen-] poor gases as well as pyroligneous juices which yield, through distillation, various chemical products that make the process quite profitable, as is being done industrially by two establishments in the Nievre. The possibility of mixing these juices with charcoal to produce a combustible liquid is being studied.

Recently, technologies have also been developed that aim to produce charcoal from various vegetable products. Thus there have been produced rotary

furnaces for palmetto-shells (operational in Ivory Coast) and gasogens in suspension for smaller shells and straw.

Aside from systems that are traditional in principle, new ways are being tested today. Thus, "flash pyrolysis," being studied at CNRS [National Center for Scientific Research] at Nancy, is an improved gasification at a temperature of 1,000 degrees C. in a very short period of time; it avoids the formation of tars and leads to a gasification which can be total, in contra-distinction to coal and pyroligneous juices. "Solar-flash" pyrolysis, on which CNRS and CNEEMA are working, is achieved by means of adding to the process a solar collector.

As to biomass hydro-liquefaction, it yields liquid hydrocarbons. It is accomplished under high pressure (300 bars) at high temperature (300 degrees C.) and in the presence of hydrogen or of a mix of hydrogen and carbon monoxide. This gaseous mixture can also be produced from biomass, after gasification, and be enriched with hydrogen. This new process is being researched in France by CNEEMA.

Methane fermentation is also an old process, since it was brought to light in 1776 by Volta, who discovered methane in swamp gas.

Methane fermentation, in order to be efficient, requires further research in micro-biology, biochemistry, and biological engineering. COMES and the European community are presently aiding the work on cellulolyse [translation unknown] and methanization (being conducted by the Universities of Compiegne and Toulouse, CNRS at Marseille and Grenoble, INSA [expansion unknown] and INRA [expansion unknown], and also the studies on methanization of various waste products and residue (INRA, CNEEMA, IRCHA [expansion unknown], IFP [French Petroleum Institute], and technical institutes). Several demonstration projects on methane fermentation are being started in a canning industry [sic] in the north of France using agricultural and food product wastes, in Ille-et-Vilaine and in Roissy for port lisier [translation unknown], in Landes for manure.

Energy production from cane in Provence is the object of a demonstration project aided by COMES, the EEC, and the Agency for Energy Economies. On a farm estate in Camargue (Private Company of Grand Manusciat--Le Sanbuc 132,00 Aries), an installation is being built (in miniature) to produce the heat necessary to the manufacture of 5,000 tons of dehydrated lucern-grass and the heating of the buildings and of 10,000 meters-square of green-houses. The Provence cane is treated by a harvesting-thrashing-loading machine that turns the stalks and leaves into shavings. It is stored, then burned and pyrolyzed. The heat and gases are used directly or stored in warm water exchangers.

The Budget for Biomass Research

In France, programs of research and development, as well as demonstration projects, have since 1979 been coordinated by COMES and its biomass-energy

committee. The biomass budget for 1980 amounts to 34 million Fr., to which are added the subsidies from the Agency for Energy Economies (400 Fr. for every TEP saved) and the individual financing of the research institutes, the total coming to about 80 million Fr. Some demonstration projects have been taken out separately to form the "green program" established conjointly by the ministries of industry and agriculture.

Part of the French program is aided by the European community (Project E: biomass energy) which is devoting 18 million Fr. over 3 years (1980-1982) to studies on biomass resources and conversion.

In the U.S.A., the budget for biomass in 1980 amounts to $57 million, or 230 million Fr. That of Sweden comes to 95 million Fr. over 4 years (1978-1981).

9516
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ENERGY

BRIEFS

NEW USES FOR WASTE HEAT--The Juelich Nuclear Research Plant (KFA) has developed new ceramic components for thermal and processing technology. The conception of these components by the KFA and the parallel development of new manufacturing methods by Rosenthal Technik AG open up perspectives for a new technology based on ceramic materials for the purpose of utilizing waste heat which thus far has gone unused. Examples which use silicon nitride as the material are the transfer of heat between gases and/or liquids with a high power-transmission density at temperatures up to more than 1,000°C, or a gas burner in which gas and air for combustion emerge together in one plane from a large number of slots in a plate made of silicon nitride; this results in homogeneous and smooth combustion with high-quality exhaust gas. The combination of such a ceramic burner element with the previously mentioned ceramic heat transfer element forms the basis for an extraordinarily compact heating device for heating water and/or industrial water with an efficiency of about 98 percent, based on the upper calorific value of the burning gas. [Text] [Hamburg ERDOEL & KOHLE ERDGAS PETROCHEMIE in German Jun 80 p 252] 12124

NEW COAL GASIFICATION PLANT--Gelsenberg AG and the Friedrich Krupp GmbH [company with limited liability] have apparently entered into a stage of concrete deliberation for the construction of a coal gasification plant. For this purpose they established a planning group which is to study the technical and economic prerequisites of a gasification plant based on Krupp's Koppers-Totzek system. The studies are to deal with matters pertaining to location, sales, coal supply and environmental questions. The North Sea coast, with the Laender Lower Saxony or Schleswig-Holstein, is being mentioned by Gelsenberg as a possible site for a plant. But an easily accessible location in the interior is not out of the question. Plans are based on a coal-handling capacity of 1 million tons per year, to produce 500,000 tons of methanol. Gelsenberg stresses that the choice of the proven Koppers-Totzek process guarantees that the construction of a coal gasification plant can be done in the next few years with calculable investment costs and reliable data on economic efficiency. [Text] [Hamburg ERDOEL & KOHLE ERDGAS PETROCHEMIE in German Jun 80 p 289] 12124

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TRANSPORTATION

EUROPE'S FIRST HYDROGEN-POWERED AUTO EXHIBITED

Hamburg ERDOEL & KOHLE ERDGAS PETROCHEMIE in German Jul 80 p 298

[Excerpt] Europe's first vehicle to be powered by liquid hydrogen was the most eye-catching example at the exhibit of the German Research and Development Institute for Air and Space Travel (DFVLR) in Hall 7 of the Hannover Fair. Because of its unequaled environmental compatability hydrogen is a very promising alternative fuel for combustion engines. In addition to the production of hydrogen and the requisite infrastructure--network of filling stations, and so forth--it is mainly questions of storage that are important. In conjunction with the University of Stuttgart the DFVLR converted an automobile into the prototype of the first experimental vehicle in Europe to be operated only on liquid hydrogen. The experimental vehicle will be used to study engine operation more intensively than to date, in the process of which in particular direct hydrogen injection into the cylinders (internal mixture formation) will be done. Liquid hydrogen is especially advantageous for this. A storage tank with a storage life of about 4-5 months will be installed later and the vehicle's power generator will be replaced by a hydrogen-air-fuel cell.

The DFVLR has also developed the first prototype of a semiautomatic filling station for vehicles using liquid hydrogen. The fueling process is program-controlled by a microprocessor. Checking for perfect hose connections to the vehicle is done by vacuum testing. At present the fueling cycle for 120 liters of liquid hydrogen takes about 8 minutes, but can of course still be reduced. When the tank is full the flow of hydrogen is automatically switched off. Partial filling is also possible. The fueling process is roughly comparable to that used for gasoline at self-service stations. Two vacuum-insulated flexible metal hoses are attached to the tank. One is used to introduce the liquid hydrogen, one as a return for the small quantities of gaseous hydrogen which develop during the fueling process. The liquid hydrogen flows out of a storage tank, which is under modest excess pressure, to the vehicle tank via the fueling station.

Through the use of modern insulation techniques vacuum-insulated tanks with a storage life of several months, that is, with negligible evaporation losses, can be built. The tank of the experimental vehicle shown in Hannover is vacuum-insulated and has a capacity of 120 liters (9.5 kg) of hydrogen (= 40 liters of gasoline). Because of the better power economy of hydrogen engines, the range per tankful comes to between 500 and 700 km in a 70-kW engine.

12124
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TRANSPORTATION

CAPRONI C22J: WORLD'S SMALLEST JET TRAINER

Milan CORRIERE DELLA SERA in Italian 26 Aug 80 p 6

[Article by Giovanni Caprara]

[Text] Milan -- The world's smallest jet-powered training plane is Italian-built. Its designers unveiled it yesterday at the corporate headquarters of its builder, Caproni, not far from Milan's Malpensa airport. It is called the C22J, and when you walk around it it looks like a fancy toy for grownups. The teardrop streamlining of its two-man cockpit is a thing of beauty. The pilot and copilot seats are arranged in the laid-back position considered de rigueur in today's advanced technology. This position, already standard in the American supersonic F-16 fighter, makes the pilot's body better able to withstand the stress of acceleration in flight.

The whole plane, its designers tell you, is extremely light: it weighs a mere 900 kilos. They achieved this by forming the entire fuselage of fiberglass and the rest of the structure of metal. Like every plane to come off the drawing-boards -- the C22J flew for the first time last July -- it still needs some last-minute technical combout to make it completely flightworthy. The man in charge of weaning it away from its designers' intensive care is a crack pilot thoroughly accustomed to performing the most difficult and complicated aerial maneuvers. He is Col Paolo Barberis, who from 1976 to 1979 commanded Italy's spectacular aerobatics team, the Tricolor Arrows. His impressions after the first test flights were flattering in the extreme: "She responds to the controls like a sweetheart."

Th C22J was a Caproni idea from the start. The company put up the entire 3 billion lire it cost to design and build, after discovering that there was no small plane available for initial jet pilot training. Until a few years ago, though, there were no small-scale jet engines on the market. These days, however, France's Microturbo company is producing them as auxiliary starters for the giant Concorde jets.

The C22J's little jets weigh a scant 30 kilos apiece, which means that they can be hand-carried, and each of them develops a thrust of 110 kilos.

There are two of them, partly for safety reasons and partly because the latest pilot training regulations call for twin jets, even in the United States.

MILAN -- The first prototype of the Caproni Vizzola C22J. The craft, a little over 6 meters overall, has a 10-meter wingspan.

"The new minijet, though," explains one of its designers, Carlo Ferrarin, "has another very important advantage. Its controls were designed to reproduce in flight the same conditions as other much larger and heavier aircraft. This means, for one thing, that a Tornado supersonic fighter pilot can practice a whole lot of maneuvers for a lot less money." An hour of flight time in the C22J in fact costs only 120,000 lire.

Next week the Caproni jet will run through its paces in the skies over Farnsborough, near London, during the international aeronautics show. There does not appear to be much stage-fright over that debut here. "We are seeing a lot of interest in our plane," says Achille Caproni, "from several Latin American countries, from all around the Mediterranean Basin, and from Germany and Austria. The Ethiopian airline is thinking of using it for its own pilot training course." And in fact the C22J seems to be beautifully adapted for initial training in either civil or military aviation.

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